REMARKS

Claims 1, 5, 7-9, 28 and 31-38 are presently under consideration in the application. Claims 1, 5, 7-9, 28, 31-32, 34, 37 and 38 have been amended herein. Claims 2-4, 6 and 29-30 have been canceled. Claims 10-27 have been withdrawn. Favorable reconsideration of the application, as amended, is respectfully requested.

I. ALLOWABLE SUBJECT MATTER

Applicants acknowledge with appreciation the indicated allowability of claim 36 subject to being amended to independent form.

II. REJECTION OF CLAIMS 7 AND 34 UNDER 35 USC §112, 2nd ¶

Claims 7 and 34 stand rejected under 35 USC §112, second paragraph, as being indefinite. Withdrawal of the rejection is respectfully requested for at least the following reasons.

Regarding claim 7, the Examiner notes that claim 7 fails to indicate from which claim it depends. The Examiner is correct that claim 7 was intended to depend from claim 1. Claim 7 has been amended herein to properly recite such dependency.

Regarding claim 34, the Examiner requests that proper Markush language be utilized. Accordingly, claim 34 has been amended to refer to the glass fixative including at least one constituent "taken from the group consisting of..." so as to be in proper form.

III. REJECTION OF CLAIMS 1-3, 7, 28-30 AND 37-38 UNDER 35 USC §102(b)

Claims 1-3, 7, 28-30 and 37-38 stand rejected under 35 USC §102(b) based on *Kramer*. Withdrawal of the rejection is respectfully requested for at least the following reasons.

Claims 1 and 28 have been amended herein so as to incorporate the features of original claim 4, and additionally so as to direct the claims to a method of bonding/bond between an optical fiber and a metallic element. For example, amended claim 1 recites a method of bonding an optical fiber to a metallic element using a glass fixative

preform. The method includes the steps of positioning a glass preform immediately adjacent to the optical fiber and the metallic element, and inducing current flows in the metallic element in the region of the preform to generate sufficient heat to melt the preform and to thereby form a bond between the optical fiber and the metallic element.

Similarly, claim 28 defines a glass material bond formed between an optical fiber and a metallic element with a glass fixative, the bond being an induced current flow bond formed by positioning a glass preform adjacent the optical fiber and the metallic element and inducing current flows in the metallic element to generate sufficient heat to melt the preform.

Original claim 4 recited the feature of a bond formed by induced current flows in the non-glass material element, the induced current generating sufficient heat to melt the preform. Claim 4 was not rejected based on *Kramer* under 35 USC §102(b). Amended claims 1 and 28 can be distinguished on the same basis. *Kramer* does not teach or suggest forming of a bond via induced current flows in the manner claimed. Accordingly, withdrawal of the rejection is respectfully requested.

IV. REJECTION OF CLAIMS 28, 30 AND 33-35 UNDER 35 USC §102(b)

Claims 28, 30 and 33-35 stand rejected under 35 USC §102(b) based on *Letter*. Withdrawal of this rejection is also respectfully requested for at least the following reasons.

As noted above, claim 28 has been amended to incorporate features of original claim 4. Claim 4 was not rejected based on *Letter*, as *Letter* does not teach or suggest such features. Accordingly, withdrawal of the rejection is respectfully requested.

V. REJECTION OF CLAIMS 4-5 UNDER 35 USC §103(a)

Claims 4-5 stand rejected under 35 USC §103(a) based on *Kramer* in view of *Knochel et al.* This rejection is respectfully traversed for at least the following reasons.

The Examiner may now consider applying the present rejection to amended claims 1 and 28. However, applicants respectfully submit that *Kramer* and *Knochel et al.*, whether taken alone or in combination, do not teach or suggest the invention as

claimed.

As noted above, amended claim 1 recites a method of bonding an optical fiber to a metallic element using a glass fixative preform. The method includes the steps of positioning a glass preform immediately adjacent to the optical fiber and the metallic element, and inducing current flows in the metallic element in the region of the preform to generate sufficient heat to melt the preform and to thereby form a bond between the optical fiber and the metallic element. Claim 28 defines a glass material bond formed between an optical fiber and a metallic element with a glass fixative, the bond being an induced current flow bond formed by positioning a glass preform adjacent the optical fiber and the metallic element and inducing current flows in the metallic element to generate sufficient heat to melt the preform.

Applicants initially note that there is an inherent difficulty in bonding an optical fiber to a metallic element in that the high temperatures usually required for such bonding may result in excessive thermal stressing of the glass material (generally silica) of the optical fiber. This leads to compromising of the mechanical and optical properties of the fiber, including possible breaking of the fiber. There is also the problem associated with the fact that such fibers are generally coated with one or more outer coatings formed from polymeric materials having a low melting point. Before the end of the optical fiber can be bonded to the metallic element the coating must be removed from the end of the fiber. However the high temperatures usually required for bonding may result in melting of the coating where it has not been removed in the vicinity of the bond.

Kramer (US 5143531) discloses only a high temperature bonding process for bonding an optical fiber 36 to a stainless steel sleeve 22 in which a glass preform 32 is paced in a cavity within the sleeve 22. Heat is then applied to the preform 32 by a propane torch in order to melt the perform, and, after removal of the heat, the fiber 36 is inserted through the feeder tube 24 so that the end of the fiber (from which the coating has previously been removed) is introduced into the molten glass to form the required bond on cooling of the glass. The softening point of the glass preform is stated to be

780°C, so that such heating must be to a temperature in excess of 780°C. Although the heat source is removed before introduction of the fiber end into the molten glass, such a temperature may nevertheless cause excessive stressing of the optical fiber as well as melting of the fiber coating in the vicinity of the bond. The need to move the fiber to introduce its end into the molten glass during the bonding process also complicates the bonding process and can give rise to bonding defects.

By contrast the bonding method that is the subject of amended claims 1 and 28 involves placing a glass preform adjacent to BOTH the optical fiber and the metallic element, and heating the perform by inducing current flows in the metallic element in the region of the perform in order to melt the preform. In this manner the bond between the fiber and the metallic element can be formed at relatively low temperature (e.g. between 280 °C and 480 °C) and without having to move the fiber or the metallic element during the bonding process. This therefore enables such bonding to be effected in a particularly simple and defect-free manner, as well as ensuring that the fiber is not unduly thermally stressed and its coating does not melt in the vicinity of the bond. This enhances the ability of the bonded fiber to withstand shock and vibration. It also means that the bond can be reworked by subsequently reheating the bond to soften the glass material (which would of course result in damage to the bond if this was done using the method of *Kramer*).

It will be appreciated that this method effects heating of the glass preform in an indirect manner in that currents are induced in the metallic element leading to heating of the element which in turn results in heating of the glass of the preform. The conductivity of the glass is not sufficient to allow direct inductive heating of the perform. Furthermore heating of the perform in this manner allows the heat to be applied only where it is required, and not in areas where it may cause undesirable effects, such as melting of the fiber coating.

The Examiner has referred to *Knochel et al.* (US 3467510) as disclosing a method of forming a glass-to-metal seal, although it will be appreciated that this reference is not concerned with the particular problem that the present invention is intended to deal with, namely the problem of preserving the integrity of the optical fibre

and its coating during bonding of an optical fiber to a metallic element. The Examiner has referred in particular to the disclosure in *Knochel et al.* (col. 3, line 60 to col. 4, line 10) of the use of heating apparatus utilizing an RF coil to heat the assembly according to a required firing schedule (column 3, line 60 to column 4, line 10).

However, applicants respectfully submit that it would not have been *prima facie* obvious at the time of the invention for the inductive heating method of *Knochel et al.* to have been used in the *Kramer* method of bonding an optical fiber to a metallic element. This is because *Knochel et al.* makes no mention of the bonding of an optical fiber, or of the associated concerns of thermal stressing of the fiber and damage to the fiber coating as a result of excessive heating. Furthermore there would be no reason for a skilled person to refer to the disclosure of *Knochel et al.* to solve the optical fiber bonding difficulties inherent in the method of *Kramer*, since *Knochel et al.* is concerned with forming of a glass-to-metal seal at high temperature (1420°C to 1550°C), and it would be appreciated by such a person that such a high temperature method would severely compromise the integrity of the optical fiber (as is taught by *Kramer*). On the contrary the skilled person would consider that *Kramer*'s method for bonding optical fiber was infinitely superior to the *Knochel et al.* bonding method, and would reject the *Knochel et al.* method as having any applicability to the bonding of optical fiber whatsoever.

Quite apart from this the particular inductive heating method disclosed in *Knochel et al.* heats a pre-fired metallic oxide composition applied to the mating surfaces of the members to be joined to a high temperature (1420°C to 1550°C), rather than relying solely on indirect heating due to the production of inductive currents in the metallic element. Thus, even if this heating method was applied in the bonding method of *Kramer* (which there is certainly no good reason for the skilled person to do), the invention of amended claims 1 and 28 would still not he arrived at.

Furthermore, the *Kramer* method differs from the method of amended claim 1 in requiring the end of the fiber to be introduced into the molten glass after the heat source has been removed. Such difference would remain however the disclosure of this *Kramer* might be combined with the disclosure of *Knochel et al.* (even if this were

considered a reasonable thing to do) or indeed any of the other references cited by the Examiner.

For at least the above reasons, claims 1 and 28 are patentably distinguished over the teachings of *Kramer* and *Knochel et al.*

VI. REJECTIONS OF CLAIMS 6, 8-9 AND 31-35 UNDER 35 USC §103(a)

Claim 6 is rejected under 35 USC §103(a) based on *Kramer* in view of *Churchill et al.* Claims 8-9 and 33 are rejected under 35 USC §103(a) based on *Kramer* in view of *Masuda et al.* Claims 34-35 are rejected under 35 USC §103(a) based on *Kramer* in view of *Letter*. Finally, claims 31-32 are rejected under 35 USC §103(a) based on *Kramer* alone. Withdrawal of each of these rejections is respectfully requested for at least the following reasons.

Each of the rejected claims depends from claim 1 or claim 28, either directly or indirectly. Accordingly, these claims may be distinguished over the teachings of *Kramer* for at least the same reasons expressed above.

Furthermore, the secondary references of *Churchill et al.*, *Masuda et al.* and *Letter* do not make up for the above-discussed deficiencies in *Kramer*. Therefore, withdrawal of the rejection is respectfully requested.

VII. CONCLUSION

Accordingly, all claims are believed to be allowable and the application is believed to be in condition for allowance. A prompt action to such end is earnestly solicited.

Should the Examiner feel that a telephone interview would be helpful to facilitate favorable prosecution of the above-identified application, the Examiner is invited to contact the undersigned at the telephone number provided below.

Should a petition for an extension of time be necessary for the timely reply to the outstanding Office Action (or if such a petition has been made and an additional extension is necessary), petition is hereby made and the Commissioner is authorized to charge any fees (including additional claim fees) to Deposit Account No. 18-0988.

Respectfully submitted,

RENNER, OTTO, BOISSELLE & SKLAR, LLP

Mark D. Saralino
Reg. No. 34,243

DATE: June 6, 2003

The Keith Building
1621 Euclid Avenue
Nineteenth Floor
Cleveland, Ohio 44115
(216) 621-1113
C:\GEN\MARS\marsp145.amd.wpd